

**University Coal Research / Historically Black Colleges and Universities &  
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**Phase Enhanced Absorption**

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A new concept, phase enhanced absorption, was introduced. The method is carried out in an absorber, where a liquid carrier (aqueous solution), an organic mixture (or organic compound), and a gas mixture containing a gas to be absorbed are introduced from an inlet. Since the organic mixture is immiscible or at least partially immiscible with the liquid carrier, the organic mixture forms a layer or small parcels between the liquid carrier and the gas mixture. The organic mixture in the absorber improves mass transfer efficiency of the system and increases the absorption rate of the gas. The organic mixture serves as a transportation media. The gas is finally accumulated in the liquid carrier as in a conventional gas-liquid absorption system.

In one aspect, the presence of the organic layer do not hinder the regeneration of the liquid carrier or recovery of the gas because the organic layer is removed by a settler after the absorption process is completed. In another aspect, the system exhibited increased gas-liquid separation efficiency, thereby reducing the costs of operation and maintenance.

Our initial study focused on the search of the organic layer or transportation layer to enhance the absorption of carbon dioxide into the potassium carbonate aqueous solution. Then, two systems were studied, CO<sub>2</sub>-Potassium Carbonate system and CO<sub>2</sub>-Potassium Carbonate-organic layer system. The first system, CO<sub>2</sub>-Potassium Carbonate system, is a traditional gas-liquid absorption process. The second system, CO<sub>2</sub>-Potassium Carbonate-organic layer system, is a novel absorption process, phase enhanced absorption. As we mentioned early, organic layer (transportation layer phase) is used for the increase of absorption rate. Our study showed that the absorption rate can be double by adding the organic layer. The experiments were conducted at 25 °C, P<sub>CO<sub>2</sub></sub> = 1 atm, the concentration of potassium carbonate was 150 g/l. However, the enhanced factor is highly depended on the liquid mass transfer coefficient.